Heating System Maintenance

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Introduction

Three-quarters of the energy used in your home is for heating water and the interior spaces. Maintaining your water and space heating systems helps ensure that this energy is used as efficiently as possible. Most of this maintenance, including one or two adjustments to the heating system and hot water tank, is simple enough for the average homeowner to carry out. The efficiency of a well-maintained, properly operated system may be 10 to 15 per cent greater than a poorly operating one.

Total energy consumption in the home depends on factors such as your family's size, the ages of its members, its lifestyle and hobbies. There are many ways to lower your total fuel consumption besides the ones emphasized in this publication. Some examples include:

- increasing the airtightness of your home with added weatherstripping and caulking
- improving the insulation value of walls, ceilings and basements
- reducing electrical energy consumption by using efficient lighting and energy-conserving appliances

Other publications in this series, such as **Basement Insulation** and **Caulking and Weatherstripping,** provide information on how to achieve these improvements.

Safety

Family and personal safety should be the primary reason for heating system maintenance. Remember that for safe operation, fuel-fired appliances need an air supply and must be properly vented to a chimney.

Visually inspect the vent connection pipes to the chimney from the furnace or boiler and gas-fired water heater (Figure 1). Check that all the joints are tight and securely fastened. Note carefully any rusted or "soft" spots in the pipes, since harmful byproducts of combustion may leak into the home through holes or gaps in the venting system. Replace deteriorating pipes immediately. The top of the metal chimney should also be periodically inspected for deterioration.

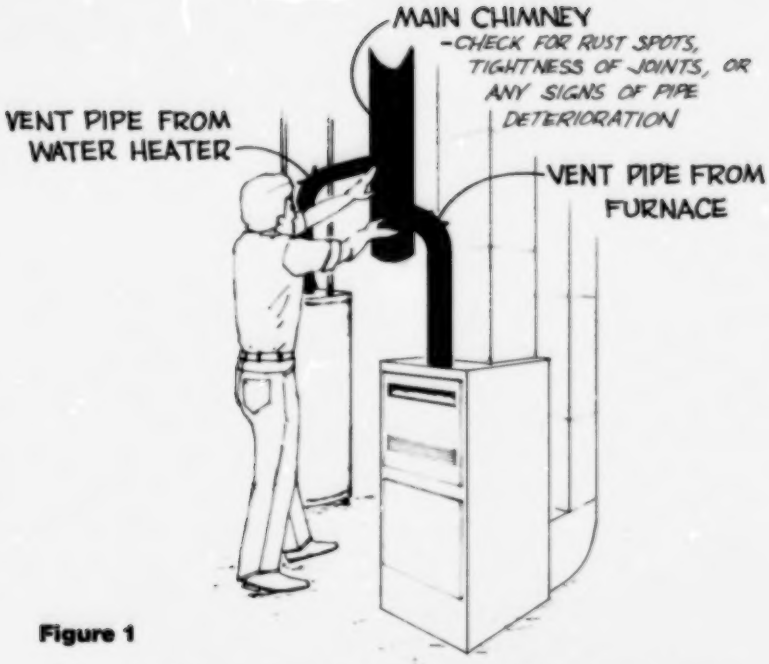
MAIN CHIMNEY
-CHECK FOR RUST SPOTS, TIGHTNESS OF JOINTS, OR ANY SIGNS OF PIPE DETERIORATION
VENT PIPE FROM WATER HEATER
VENT PIPE FROM FURNACE

Figure 1

Masonry chimneys must be lined with metal or ceramic liners when used for exhausting gas appliances. With a mirror in the cleanout access, visually inspect the chimney lining and check for blockages. Make sure all openings, other than those servicing the furnace and hot water heater, are closed off. This includes those unused openings used in the past for a kitchen range or gas space heater.

Signs of excessive carbon or rust deposits, escaping fumes or irregular flame patterns should be reported immediately to your utility company. **If there is a gas odour present, ventilate and evacuate the area and avoid flame or electrical spark sources such as light switches while waiting for the utility company representative.**

Check for obstructions that reduce the combustion air supply to the furnace and hot water tank. It's important not to store any items close to the furnace or hot water tank. Ensure that they are not enclosed in a small area without an air supply and never operate them with any access panels removed.

As a home becomes better sealed, a shortage of combustion and draft air for the fuel-fired appliances may result. This can cause combustion gases to be drawn back into the house, a condition called backdrafting. Other appliances that exhaust air from the home can further aggravate the problem. These include exhaust fans, fireplaces, woodstoves and clothes dryers. If you can smell combustion gases near the furnace or hot water tank, or if a fireplace does not draw properly unless a window is open, then backdrafting may be occurring. **Backdrafting is a serious health hazard and should be remedied immediately.**

Opening a window or door will provide a short-term solution. A more permanent solution is to provide a combustion air inlet. Several methods are approved for bringing combustion air to the furnace and hot water tank. One technique involves installing an open-ended duct from outside which ends six to 18 inches from the floor, as shown in Figure 2a. While effective, this method can create cool drafts in an open basement. However, automatic dampers are available which close the duct when the furnace is not operating.

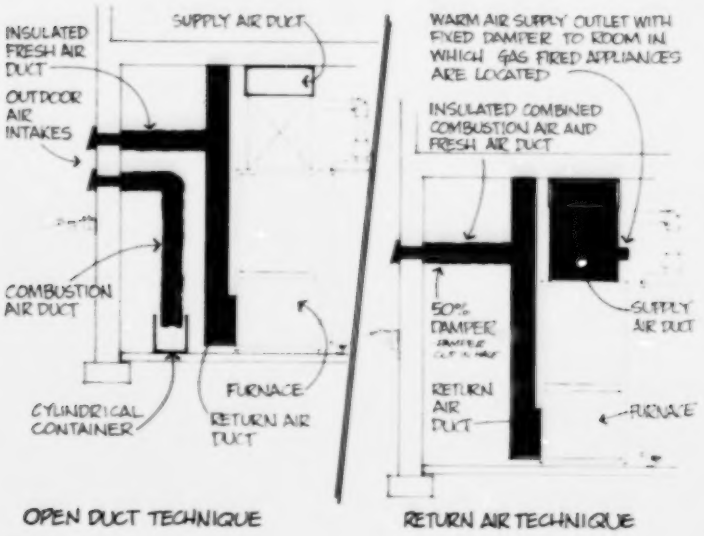

Figure 2

A second technique, shown in Figure 2b, brings the combustion air duct into the furnace's cold air return and provides an opening in the warm air plenum for combustion air to feed the furnace. The size of these lines depends on several things including appliance rating and house construction. Consult your local gas inspector, furnace contractor or the provincial inspection authority of Alberta Labour to determine proper sizes for the ducts.

Water Heater Maintenance

Although hot water heaters have no moving parts, they will wear out over a period of time. You can improve their life expectancy and efficiency with proper maintenance. Every one or two months, water should be drained from the outlet at the base of the tank to keep sediment from building up (Figure 3). Drain eight to 10 litres (two gallons) of water until it runs out clear, indicating the sediment has been removed. If the drain valve is stuck shut from lack of use and you cannot open it by hand, do not attempt to force it open unless you have a replacement valve.

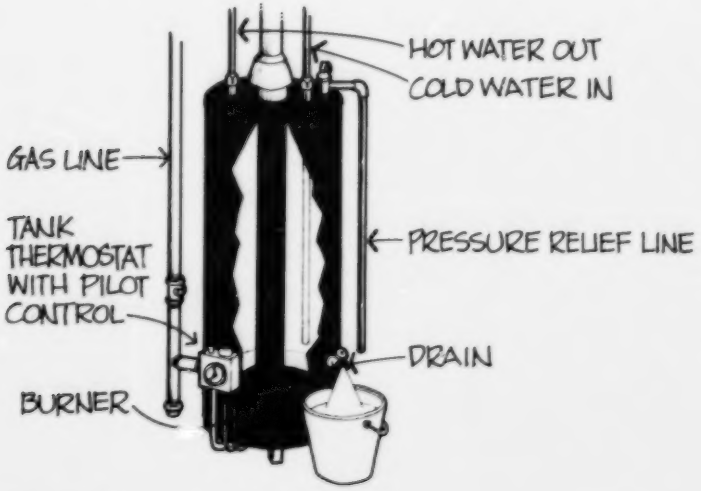

Figure 3

The temperature setting of the hot water tank should be no higher than required. If you use an automatic dishwasher without a preheater, the maximum recommended water temperature is 60°C (140°F). If not, set the temperature so that at the furthest faucet from the tank you can just tolerate the hot water on your hand (about 50°C or 120°F). Water temperature settings above 50°C can scald hands, especially those of young children. Alter the temperature by rotating the large control dial on the gas-fired water heater. **If you have an electric water heater, the temperature can only be altered after shutting off the power and then removing the cover plates over the elements and making the adjustments with a screwdriver. Consult the service manual provided with the water heater.**

You can increase the efficiency of the hot water system with tank and pipe insulation (Figure 4). Wrapping a hot water tank with insulation decreases the heat loss from the tank. Older tanks, in particular, benefit because they are not as well insulated as new models. You can purchase a kit or do the work yourself with foil-faced fibreglass duct insulation. **When insulating a gas-fired water heater, make sure the top is not covered so that the draft hood is not blocked and do not cover the air inlet, the controls or the operating instructions for the burner and pilot light. Make sure the insulation is securely fastened so that it can never come loose, fall and cover the air inlet or controls.**

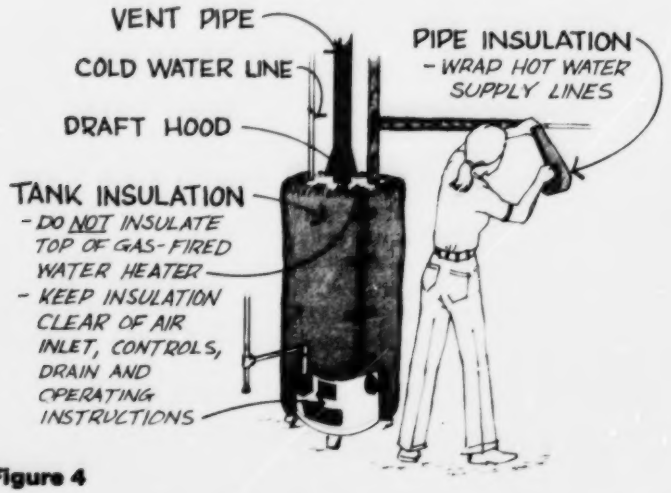
VENT PIPE
COLD WATER LINE
DRAFT HOOD
TANK INSULATION
- DO NOT INSULATE TOP OF GAS-FIRED WATER HEATER
- KEEP INSULATION CLEAR OF AIR INLET, CONTROLS, DRAIN AND OPERATING INSTRUCTIONS
PIPE INSULATION
- WRAP HOT WATER SUPPLY LINES

Figure 4

Insulation can be applied to the hot water supply lines and may reduce both energy and water costs, since less water is used to bring hot water to a faucet.

If you are leaving your home unoccupied during a long holiday, and if you feel confident about relighting your gas water heater, you can save energy and money by shutting off the water heater while you are away. An alternative is to simply turn down the thermostat to its lowest setting.

When replacing a hot water tank, you may have the option of using either a fuel-fired gas or propane unit or an electric one. Conventional fuel-fired hot water tanks operate at 50% to 55% efficiency. They also require a flue. Electric water heaters on the other hand operate at 100% efficiency and need no venting. However, at present prices, electric water heating costs 2.5 to 3 times more than natural gas, and is about the same as propane. A typical Alberta home might pay $120 per year for heating water with natural gas, $300 per year with electricity or propane.

Heating System Maintenance

If you live in Alberta your home is probably heated with a natural gas or propane-fired forced air, gravity or hot water heating system. The maintenance of these different systems is covered in the following sections, but one common requirement is the need for fresh air for combustion and for proper chimney operation.

A lot of heat produced by a conventional furnace is lost up the chimney. This is necessary in order to properly vent combustion products. **Adding heat reclaiming devices to the flue to recover this heat is not only illegal but also very dangerous.** It could cause water vapour to condense in the chimney and result in corrosion. This condensation may freeze and block the chimney in very cold weather. New improved-efficiency "chimney-less" furnaces designed to eliminate this problem are discussed in another publication in this series, **Selecting a Heating System.**

Forced-Air Systems

A typical forced air system is shown in Figure 5. Proper and efficient operation depends on maintaining an unobstructed air flow through the furnace's air circulation system.

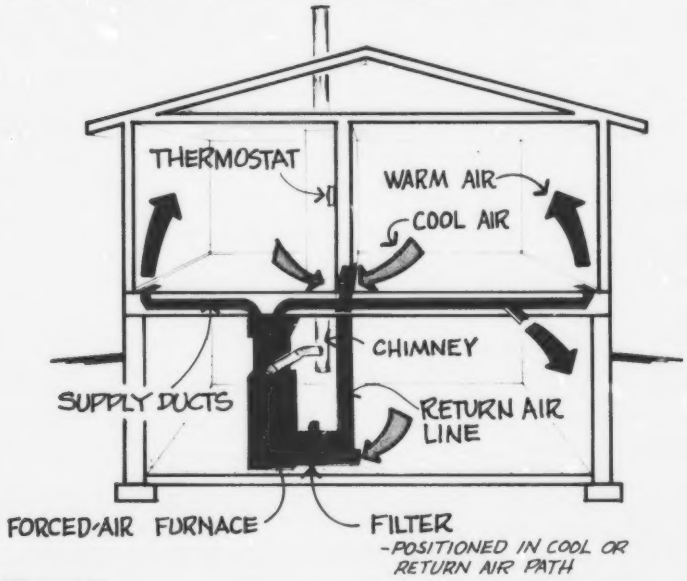

Figure 5

The easiest and most effective way to achieve this is to keep the filter clean. If the filter becomes clogged and dirty, air movement slows and efficiency drops because heat is not removed from the furnace heat exchanger fast enough. Reduced air flow can also result in poor heat distribution throughout the home, especially in those rooms furthest from the furnace.

The most common styles of filters are illustrated in Figure 6. Disposable filters made of cardboard and fibreglass should be changed monthly during the heating season. Permanent filters should be cleaned monthly by vacuuming or washing. Other types of filters, such as electronic or charged media, should be maintained as outlined by the manufacturer. Usually, they too will require a monthly cleaning cycle during the heating season.

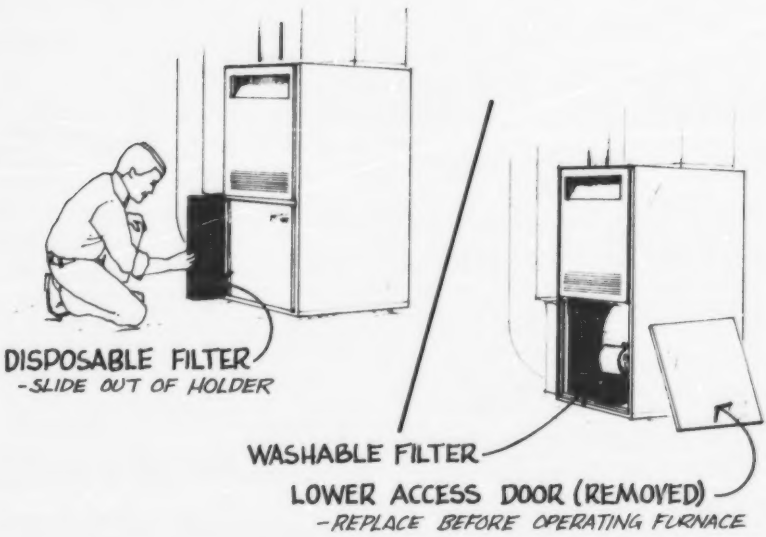

Figure 6

Keeping the entire duct system clean will prevent the filter from clogging frequently. Remove the registers (diffusers) and vacuum the duct as far as you can reach to remove most of the dust and dirt. If you suspect heavier amounts of dirt, a commercial furnace and duct cleaning service may be hired to clean the entire system.

Air flow also depends on the condition of the motor and blower. Lubrication of the bearings should be the only maintenance required. After **turning off the power to the furnace,** remove the lower access panel to expose the motor and blower assembly. Twice a year add 2 or 3 drops of a non-detergent electric motor oil to each oil port (Figure 7), more often if you are running the fan continuously. If there are no oiling ports, the motor and blower have sealed bearings requiring no external lubrication.

If your fan is not directly driven (with the motor mounted inside the fan assembly), check the belt drive between the motor and blower fan. Proper tension can be set by changing the angle of the motor. There should be 20 mm to 30 mm (¾ inch to 1¼ inches) of slack in the belt midway (Figure 8).

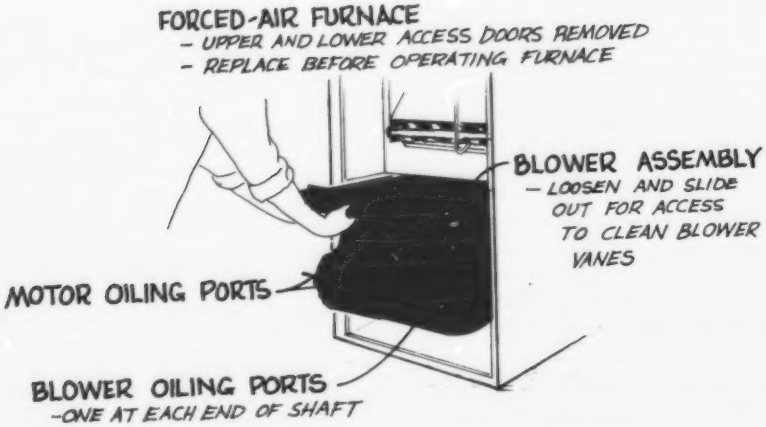
FORCED-AIR FURNACE
- UPPER AND LOWER ACCESS DOORS REMOVED
- REPLACE BEFORE OPERATING FURNACE
BLOWER ASSEMBLY
- LOOSEN AND SLIDE OUT FOR ACCESS TO CLEAN BLOWER VANES
MOTOR OILING PORTS
BLOWER OILING PORTS
-ONE AT EACH END OF SHAFT

Figure 7

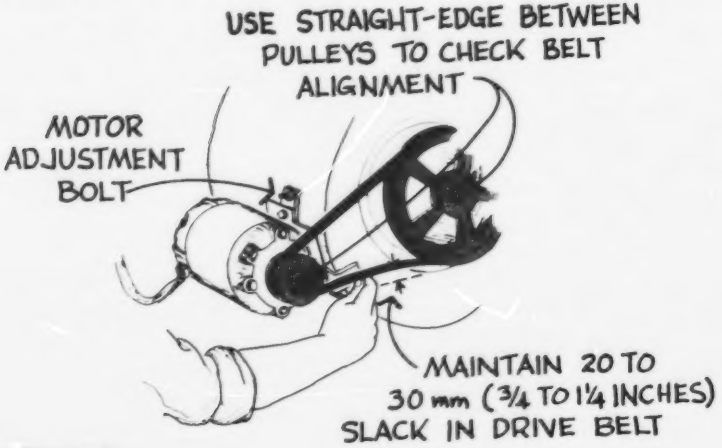
USE STRAIGHT-EDGE BETWEEN PULLEYS TO CHECK BELT ALIGNMENT
MOTOR ADJUSTMENT BOLT
MAINTAIN 20 TO 30 mm (¾ TO 1¼ INCHES) SLACK IN DRIVE BELT

Figure 8

Examine the belt condition and alignment at this time. Again **make sure the power is off.** If the belt is cracked, frayed or worn, replace it. Loosen the motor, remove the worn belt, install a new one of the proper size and adjust it to the proper tension. Use a straight-edge or look along the belt to see if the pulleys are lined up properly. If the pulleys are not aligned, loosen the motor pulley, slide it one way or the other on the shaft, and then retighten the pulley.

While the lower access panel of the furnace is removed, look at the blower vanes. Any soil buildup on the vanes will impede efficient operation and air flow. Loosening a few bolts will usually allow the assembly to be exposed enough to scrape and vacuum blower vanes.

To completely clean the blower, remove it entirely from the furnace, disconnect the motor, and take the blower to a coin-operated car wash. This will remove built up grime on the vanes. Remount the motor/blower assembly, and then replace the lower access door and turn the power back on to the furnace. **Do not operate the furnace without all access doors in place.**

Inadequate air flow can also cause the furnace burners to cycle on and off, which reduces operating efficiency. One cause of this is the blower running too slowly. The speed of the blower fan can be increased by changing the diameter of the motor pulley or by tightening the belt if it is loose and slipping. **Remember to turn the power to the furnace off before making any adjustments.** Most motor pulleys are variable-speed types and can be increased in size by loosening a locking screw, twisting the pulley halves closer together, and then retightening the screw (Figure 9). Adjust the pulley in small steps until frequent burner cycling stops.

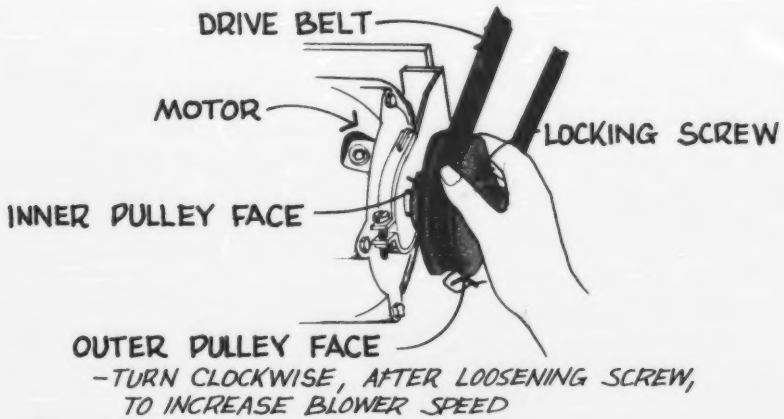

Figure 9

Inefficient furnace cycling can also be reduced by adjusting the anticipator setting in your thermostat (Figure 10). This is a small movable arm or dial inside the body of most thermostats. By moving it to a higher setting or in the direction marked "longer" you will increase the temperature range over which the furnace is on. This makes the furnace run less frequently and means it will burn less fuel. Adjust the anticipator bit by bit over a period of a week to find the optimum point. If you find you're getting too cool before the furnace comes on, then you've gone a bit too far and should reduce the anticipator setting.

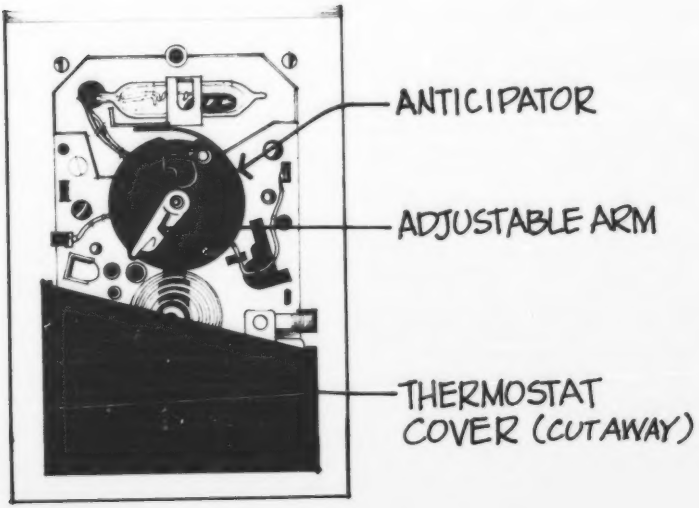

Figure 10

If the blower cycles on and off frequently, you may need to adjust the fan-control limit switch (usually located in a control box in the furnace). Altering the fan control to lower "start" and "stop" temperatures will make the blower fan start sooner and run longer during the furnace heating cycle. Firmly holding the dial face of the limit control, adjust the start and stop temperature setting pins to 120°F and 90°F respectively. There is a third pin (usually fastened in place) which is the overheating limit shut-off. Do not alter the setting of this pin, normally set at 200°F or above, since lowering it may cause the furnace to stop operating.

Gravity Systems

Gravity furnaces have no fan to move the air. The action of heated air rising and cooled air falling circulates heat from the furnace throughout the home.

The major maintenance involved in a gravity system is keeping the duct system clean and unobstructed. It is very important that both supply and return air ducts be free of any buildup of dirt and that no furnishings be placed over the grilles. Gravity systems usually rely on thermostats for temperature control, so lowering the temperature settings at night will reduce costs.

Hot Water (Hydronic) Systems

The layout of a typical residential hot water heating system is shown in Figure 11. There are various systems in use (series loop, one pipe, two pipe, etc.) but most rely on a circulating pump to move hot water through baseboard convectors to heat the air in the home.

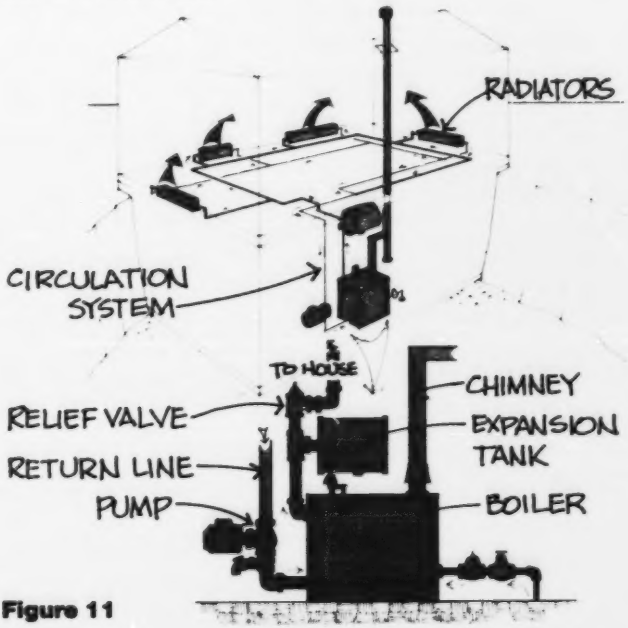

Figure 11

A minimum of maintenance is required with a hot water heating system. Lubrication of the circulation pump twice a year is important. Place a few drops of non-detergent electric motor oil into the oil cups at both ends of the motor and on the top of the bearing assembly between the motor and pump body (Figure 12).

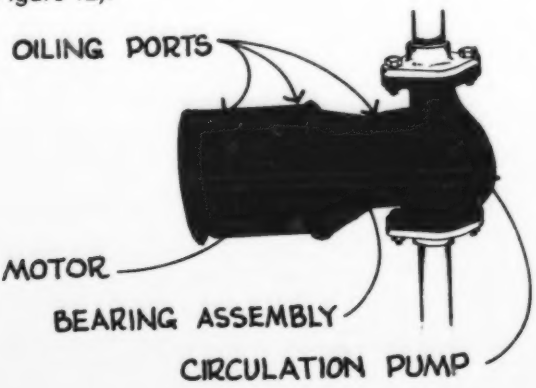

Figure 12

Other servicing requirements include bleeding air from the system, maintaining the water level and occasionally adding corrosion inhibitor. Procedures for adding water and removing excess air vary among systems. Consult service manuals or a heating contractor for information on these maintenance operations.

Some old systems use gravity rather than a pump to circulate water. Adding a pump to the system can increase efficiency by up to 30 per cent. The pump should be installed with a bypass to permit repair without draining the whole system. Since the volume of water is often greater in gravity systems than newer ones, get professional advice about the appropriate pump capacity.

If you have an aquastat (a water temperature control) on your boiler, consider reducing the minimum temperature to 50°C (120°F) during the warmer months of the heating season. The adjustment can be done by turning a screw located on the body of the aquastat. Lower water temperatures will reduce overheating in spring and fall. This adjustment should not be done with stainless steel boilers or where the boiler also heats domestic hot water.

Thermostat Setback

You can save energy by turning down your furnace thermostat during the night to 17°C (63°F) instead of leaving it at 20°C (68°F) and by leaving it down during the day if no one is home. This energy saving is available at no extra cost by setting the thermostat back manually. Each 1°C setback in temperature overnight, if done regularly during the heating season, will reduce your annual heating bill by one to one-and-one-half per cent.

Automatic setback thermostats will ensure settings are altered each and every day. Override switches on the thermostats enable you to bypass the automatically lowered settings, for example, on a weekend when everyone is home during the day.

Automatic setback thermostats operate by using a 24-hour clock or timer which can be programmed to raise and lower the temperature settings for specified periods. Some units can control two or three setback periods per day; other units only offer one period. Many have optional five or seven day programs so that weekends can be programmed separately from weekdays. Most replacement units will use the existing two low-voltage wires from your furnace for operation, but check to see that the thermostat voltage specifications match the voltage requirements stamped on the furnace nameplate.

Most automatic setback thermostats can be installed by the homeowner. Those that require additional wiring may pose problems if new wiring cannot easily be threaded through the wall. Remember, when installing or replacing a thermostat, place it on an inside wall away from drafts, direct sunlight or heat sources such as a refrigerator, heat ducts or chimney behind the wall. Mount it about 1.5 metres (5 feet) from the floor and away from heavy traffic areas.

Summary

- Inspect all vent and chimney connections for proper fit, rusting or deterioration.
- Clean air filter monthly during heating season.
- Set water heater temperature as low as possible.
- Lubricate blower motor or circulation pump and check belt drive twice a year.
- Drain water heater every month or two.
- Set temperature back at night and when no one is home. Consider an automatic setback thermostat.

Proper heating system maintenance makes sense. You will reduce fuel costs, extend the life of your equipment and have a safer system by following this simple maintenance schedule.